



The Space Rush: Reviewing Indonesia's Space Law in Facing the Rise of Space Mining

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ABSTRACT

Space technology development shows feasibility of actualizing future space mining. There are numerous efforts to utilize resources from celestial bodies; whether as fuel, an alternative source for scarce minerals, or as an in-situ support for future human habitation in outer space. This article identifies potential clashes between ongoing space mining practices and the interests of developing nations. The main concern is accessibility: will the race to dominate space mining leave no room for non-space faring nations to utilize space resources, or even access potential space mining locations? The current international space law has several loopholes such as the absence of provisions regarding ownership of space resources, and the lack of inclusion of private actors, especially considering their role in furthering the space mining industry. This article also examines Indonesia's regulation on space activities, including mining and provide recommendations. Current regulations imply there is a vision for Indonesia to be a large space actor in the future, but no instrument puts specific focus as of yet to space mining. Lack of dedicated funding and technology also exist, but there are various opportunities to attain this, provided Indonesia is able to utilize them for national interests.

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1. Introduction

Mankind's growth of population is proportional to how much resources it needs to sustain life on Earth. Nature's limitations in providing these needs has invoked the search for potential resource alternatives in outer space, namely what could be found on the moon and asteroids. These celestial bodies contain rocks, precious metals, and water to support both human necessities and space operations.

To demonstrate, platinum is a precious metal used in producing medicine, jewelry, electronic appliances, even space vehicle components. Outer space's lower pull of gravity compared to earth means platinum could be found nearer to the surface on asteroids.¹ Current technology is unable to precisely detect the level of platinum contained in asteroids but according to estimations, a single asteroid may be valued at 25–50 million dollars.²

Water is another crucial resource for deep space exploration.³ Scientists predict there is 600 million metric tons of water or ice reserves in forty craters⁴ located on the dark side of the moon. The amount of hydrogen contained in these craters could produce enough fuel to launch a space shuttle per day for 2,200 years.⁵

These examples are only two out of many that show mankind can look to celestial bodies for their needs. Even now, scientists discuss the possibilities and models of having self-sustaining settlements in space. In theory, humans living in these settlements will be able to produce their own food and gain materials for building through *in situ* resource utilization (ISRU).

Despite these fantastic numbers and the general enthusiasm surrounding space mining, there is still no effective method in transporting large quantities of space resources. The financial cost must be considered, for moving two ounces of minerals from an asteroid back to earth costs approximately a million dollars.⁶ This raises a question: will investments be worth the results? A worry that casts doubt on space mining prospects compared to terrestrial mining.⁷

Space mining as an industry holds tremendous potential, and the barriers do not stop efforts to delve into the sector, especially from the private sector. Achieving space mining practice will take time, but developing countries, including Indonesia, must compete for the chance to utilize space resources. With no technological capacity nor sufficient funding, Indonesia could at least begin with planning. One means to welcome the era of space mining is to formulate regulations for national stakeholders facing possible issues which may rise when the space mining industry is finally in effect.

This article attempts to disseminate how the rights of developing countries to conduct space activities is affected by ongoing space mining practices, whether implemented or in planning. It will use Indonesia's specific legal perspective as a developing country with interests for future use of outer space.

First, to help the reader gauge present developments in the industry, this article will lay out current and near-future plans for space mining missions alongside potential

¹ Robert Hackett. (2015). *Asteroid Passing Close to Earth Could Contain \$5.4 Trillion of Precious Metals*. Available online from: <http://fortune.com/2015/07/20/asteroid-precious-metals>. [Accessed July 7, 2019].

² Jim Edwards. (2017). *Goldman Sachs: Space-Mining for Platinum Is 'More Realistic than Perceived'*. Available online from: <https://www.insider.com/goldman-sachs-space-mining-asteroid-platinum-2017-4>. [Accessed January 27, 2020].

³ Andrea Thompson. (2009). *Significant Amount of Water Found on Moon*. Available online from: www.space.com/7530-significant-amount-water-moon.html. [Accessed July 7, 2019].

⁴ The National Aeronautics and Space Administration. (n.d.). *NASA Radar Finds Ice Deposits at Moon's North Pole*. Available online from: https://www.nasa.gov/mission_pages/Mini-RF/multimedia/feature_ice_like_deposits.html. [Accessed July 6, 2019].

⁵ Paul Rincon. (2010). *Ice Deposits Found at Moon's Pole*. Available online from: <http://news.bbc.co.uk/2/hi/science/nature/8544635.stm>. [Accessed July 8, 2019].

⁶ Rob Davies and Glenn Swann. (2016). *How Would Asteroid Mining Work? A Visual Guide*. Available online from: <https://www.theguardian.com/business/ng-interactive/2016/feb/06/how-would-asteroid-mining-work-a-visual-guide>. [Accessed July 6, 2019].

⁷ Scot W. Anderson, Korey Christensen and Julia LaManna. (2018). "The development of natural resources in outer space". *Journal of Energy & Natural Resources Law*, 37(2): 227–258.

threats that may rise from it. The second part shall elaborate existing space mining regulations, both international and national laws, and how these rules affect the rights of developing countries. Thirdly, it focuses on Indonesia's legal framework as a foundation of how space mining will transpire under national jurisdiction. This part also contains several recommendations for future rules and regulations. The end of this article will function as a conclusion.

Readers will become aware about Indonesia's legal framework as a developing countries and it stands to face the emerging space mining era. This writing is hoped to give input for the future development of space mining regulations.

2. Space Mining Development

Hayabusa is Japan Aerospace Exploration Agency (JAXA)'s first mission, intended to retrieve samples from the 25143 Itokawa asteroid for analysis. It launched on 9 May 2003 and reached Itokawa mid-September 2005.⁸ After studying the asteroid, Hayabusa collected samples and landed on 13 June 2010. Prior to Hayabusa, Galileo and NEAR Shoemaker designed by NASA also reached their targeted asteroids but failed to land.

Following Hayabusa's success, JAXA executed its successor, Hayabusa2, to extract samples from 162173 Ryugu, an asteroid composed of minerals, ice, and other organic materials. Space missions remains the only viable way to gather pure, organic minerals without terrestrial contamination.⁹

Another projection for space mining is ISRU. Companies dabbling in space mining realize ISRU is a lucrative business. Water extracted from the moon may be used for future settlements as fuel,¹⁰ protection from radiation, and for consumption.¹¹ Other components such as metals may also be used *in situ* to construct space vehicles parts.¹² This means the moon may be used as a fuel and repair station which eases deep space exploration and cuts costs, making space activities (especially those done in deep space) more sustainable.¹³

Space activities will not cease any time soon, and this makes space mining an attractive industry. The market which could utilize space resources in all its forms already exists and will only continue to grow.

The full realization of space mining will take at least a few years, but its appeal is undeniable. Despite technical and financial obstacles, space mining is still viewed as a lucrative industry in the future. Discussions in the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS)¹⁴ support this statement.

⁸ The National Aeronautics and Space Administration. (2018). *Two-Way Asteroid Trip Takes Off*. Available online from: https://www.nasa.gov/connect/ebooks/beyond_earth_detail.html. [Accessed July 7, 2019].

⁹ Tachibana, et. al. (2014). "Hayabusa2: Scientific importance of samples returned from C-type near-Earth asteroid (162173) 1999 JU3". *Geochemical Journal*, 8: 571-587.

¹⁰ The National Aeronautics and Space Administration. (n.d.). *Developing Technologies for Living off the Land...in Space*. Available online from: www.nasa.gov/exploration/analogs/isru. [Accessed July 13, 2019].

¹¹ Mike Wall. (2015). *Asteroid Mining May Be a Reality by 2025*. Available online from: www.space.com/30213-asteroid-mining-planetary-resources-2025.html. [Accessed July 16, 2019].

¹² Rob Davies and Glenn Swann, *loc. cit.*

¹³ Scot W. Anderson, et.al., *loc. cit.*

¹⁴ COPUOS is the appointed focal point for outer space issues. The United Nations General Assembly (UNGA) Resolution 1348 (XIII) of 13 December 1958 included provisions to form an AdHoc Committee on the Peaceful Uses of Outer Space, which later became permanent based on UNGA Resolution 1472 (XIV) of 12 December 1959.

As the focal point of outer space issues, COPUOS has two permanent subcommittees, the Legal Subcommittee (hereinafter LSC) and the Scientific and Technical Subcommittee (hereinafter STSC). Both subcommittees hold annual meetings separate from their parent COPUOS meeting. The last few years has witnessed presentations from various states and organizations regarding space mining in both subcommittee and parent meetings, each with their own viewpoint on the issue. Topics span from feasible ISRU models on Mars¹⁵, sustainable ISRU¹⁶, studies on drilling operations in outer space¹⁷, and United Arab Emirates' projection for space mining as part of its future space regime¹⁸.

Companies taking interest in space mining have also emerged. Planetoid Mines Company earns its prominence as a New Mexico-based company focusing in *in situ* mining on the moon and asteroids.¹⁹ Planetary Resources is another reputable company, its practice area involving space resource identification on asteroids with a goal of harvesting water from celestial bodies.²⁰ Lastly, Luxembourg-based Offworld has a mission to pursue sustainable development in space through solar power in outer space along with supplying mankind's needs found on the moon and asteroids.²¹

All three companies endeavor to extract energy from outer space—a basic need for any space activity. This is especially true for Planetary resources, aiming to support sustainable human life in outer space and deep space exploration missions. Another trait these companies share is the willingness to pour out funds for continuous research to accelerate the realization of space resource exploitation. The Hayabusa2 mission has not even concluded, but various plans have risen to mine water and minerals on a larger scale. Plans to commercialize water and minerals *in situ* implies plans for permanent residence in outer space.

Organizations, companies, and other entities projecting these space mining ambitions generally come from space faring countries. This raises concerns from non-space faring countries. The coming years may see levels of exploitation so high that it would be hard to access the remaining space resources. If projects continue to sprout in finite areas such as the moon's and Mars' surface, non-space faring countries may not get the chance to enjoy the resources' benefits. Projects undergoing and planned for the near future also target more accessible asteroids and other parts of space, meaning there would be a further financial and technological gap for non-space faring countries to catch up with their own space mining programs.

¹⁵ See Javier Martin-Torres. (2019, January). *Habit* [PPT slides]. Presented at the 56th Session of STSC, Vienna. Available online from: <http://www.unoosa.org/documents/pdf/copuos/stsc/2019/tech-41E.pdf>.

¹⁶ See Michelle Hanlon and Judith Beck. (2019, February). *Encouraging the Sustainable Exploration of Space by Using ISRU to Mitigate the Plume Effect* [PPT slides]. Presented at the 56th Session of STSC, Vienna. Available online from: <http://www.unoosa.org/documents/pdf/copuos/stsc/2019/tech-61E.pdf>.

¹⁷ See Chris Welch. (2017, January). *Lunar Hathor: International Deep Drilling Lunar Mission Study* [PPT slides]. Presented at the 54th Session of STSC, Vienna. Available online from: <http://www.unoosa.org/documents/pdf/copuos/stsc/2017/tech-09E.pdf>.

¹⁸ See Omran Sharaf. (2017, February). *Overview on the Emirates Mars Mission (EMM)* [PPT slides]. Presented at the 54th Session of STSC, Vienna. Available online from: <http://www.unoosa.org/documents/pdf/copuos/stsc/2017/tech-24E.pdf>.

¹⁹ Planetoid Mines. (n.d.). *About Us*. Available online from: <http://www.planetoidmines.com/wp/about-us/>. [Accessed July 8, 2019].

²⁰ Planetary Resources. (n.d.). *About the Exploration Program*. Available online from: <https://www.planetaryresources.com/missions/arkyd-301/>. [Accessed July 8, 2019].

²¹ Offworld. (n.d.). *Offworld's Masterplan*. Available online from: https://docs.wixstatic.com/ugd/3823cc_71d3cdd3ba8a4b958d3ceea7a15bd8ef8.pdf. [Accessed July 8, 2019].

This condition has resulted in non-space faring countries turning to the law as an effort to ensure they too will be able to access space resources and conduct space mining with no significant barrier in the future. The next part of this article shall review existing regulations on space mining and general utilization of space resources.

3. Existing Law and Impacts Towards Developing Nations' Rights

Understanding how law impacts the right to access outer space and its resources will give insight to the concerns coming from non-space faring countries. This part shall first examine the international regime which lays the foundation and guidelines of conducting space activities. Then, it further discusses national laws. Finally, this part shall analyze the impacts of both international and domestic law's impacts towards how developing countries' rights to conduct space mining is exercised.

3.1. Space Law

The existing space law touches upon space exploration and exploitation in a general sense. Article one of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereinafter OST) acts as space law's *magna carta*. It declares the moon and other celestial bodies as the province of mankind.²² Thus, sovereignty is not acknowledged in outer space, and its use must benefit all mankind.

Meanwhile, the non-appropriation principle²³ in Article 2 guarantees access to use of outer space in accordance with each state's interests,²⁴ irrespective of their stage of development. OST has no particular provisions for space resources in the space mining context since it was a relatively unforeseen problem at the time of its formulation.²⁵

Space resources must be used for the benefit of all countries according to prevailing laws. Each state may determine their own form of participation in space activities, including how they execute international cooperation. In the interest of balancing out competing interests, states wishing to execute space activities are obliged to consult potentially affected parties, including possible risks or disruptions of their existing space missions.

Clauses in OST are strengthened and further elaborated in The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979 (hereinafter Moon Agreement). It contains the common heritage of mankind doctrine which provides rights for future generations to inherit and use outer space (and its resources).²⁶ This doctrine demands outer space to be kept serviceable for years to come and, by extension, for space activities to be sustainable. Some experts view that

²² The "province of mankind" concept guarantees access to benefits stemming from outer space exploration and exploitation. This principle applies to space activities but not outer space itself. David Tan. (2000). "Towards a New Regime for the Protection of Outer Space as the "Province of All Mankind"". *Yale Journal of International Law*, 25(1): 145-194. Available online from: <https://pdfs.semanticscholar.org/16cd/f9b063cae68c037ec9dab376c08496e43a32.pdf>.

²³ "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."

²⁴ Fabio Tronchetti. (2007). "The Non-Appropriation Principle Under Attack: Using Article II of the Outer Space Treaty in Its Defence". The 68th International Astronautical Congress Symposium. Available online from: <https://iislweb.org/docs/Diederiks2007.pdf>. [Accessed August 10, 2019].

²⁵ Fabio Tronchetti. (2009). *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies: A Proposal for A Legal Regime*. Boston: Martinus Nijhoff Publishers.

²⁶ Article 11 (1) Moon Agreement.

Article 1 and 2 of OST presents similar views with this doctrine²⁷ as it implicitly bans exclusive use²⁸ of outer space.

Space activities and extracted resources needs to be managed on an international level in implementing the common heritage of mankind doctrine.²⁹ The Moon Agreement created provisions for this by mandating the formation of an international regime to regulate space activities which use space resources such as space mining, including how extracted resources would be divided.³⁰ The allotment would consider both developing countries' right to access benefits of space resources and the contributions of developed, space-faring countries in extracting those said resources. These considerations have one goal in mind: to ensure optimal use of space resources found on the moon, other celestial bodies, or even in the use of orbits.

Another effort in optimizing the benefits of space resources lies in the sharing of benefits. Operators are obliged to disclose some information on how they execute space activities along with the results of their scientific research so it may be accessible for other countries. For missions longer than sixty days, there needs to be a periodic report. This information serves as an education tool and increases efficiency for parties involved in space activities because it provides a chance of understanding space mining operations on a deeper level.

The Moon Agreement contains provisions that envision a regulated space mining regime. Compared to OST, it is abler in anticipating the development in space activities, both in potential future usage of resources and the rising inclusion of the private sector in conducting them. However, the implementation of this seemingly ideal instrument is another story. A potential problem arises from Article 11 which states that "natural resources ini place" cannot be claimed as property of a state. This phrasing is treated as a loophole; there is no prohibition of ownership given for resources brought back to earth.

Another factor that may hamper implementation is the low number of member states and signatory states to the Moon Agreement. To date, there are only 18 member states and 11 signatories of the Moon Agreement.³¹ There may be various reasons for this; its relatively heavier burden for member states and signatories, concerns over legal voids, et cetera. No matter the cause, this number is proportionate to how powerful the pressure could be for other states to sign, ratify, and implement the Moon Agreement in their national space activities. Low numbers mean there is not enough parties to muster the necessary pressure for compliance.

The call for an international regime is an agenda for the United Nations General Assembly (UNGA) sessions, though there are no signs of it coming into fruition in the near foreseeable future. UNGA sessions show the intention to build a universally accessible space regime. The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (hereinafter Space

²⁷ Sarah Coffey. (2009). "Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space". *Case Western Reserve Journal of International Law*, 41(1): 119-147.

²⁸ John Adolph. (2006). "The Recent Boom in Private Space Development and the Necessity of an International Framework Embracing Private Property Rights to Encourage Investment". *The International Lawyer*, 40(4): 961-986. Available online from: www.jstor.org/stable/40708019.

²⁹ Barbara Ellen Heim. (1990). "Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space, and Antarctica". *Vanderbilt Journal of Transnational Law*, 23: 819-839.

³⁰ Article 11 (5) Moon Agreement.

³¹ United Nations Treaty Collection. Available online from: https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXIV-2&chapter=24&clang=en. [Accessed August 11, 2019].

Benefits Declaration) urges space faring countries to promote space activities and instigate cooperation that will attract developing countries. Again, its non-binding nature raises questions on its effectivity in implementation.

Other than limited financial and technology capacity, there is yet a legal system to defend the rights of developing countries or non-space faring countries. There is no punishment system set in stone save compensation for damages suffered as a third party. Space law implementation still relies heavily on how each state runs their space activities. As such, there is pressure for space faring countries to act in line with their international obligation.

The International Court of Justice (ICJ) through the Nuclear Tests Case states the principle of good faith as the foundation of legal obligation formation, followed by its demand for implementation. The concept of *pacta sunt servanda* as we know it in treaties is based on having expectations that all parties shall act in good faith and obey agreed contracts.³² States which fulfil their obligation according to the good faith principle would not misuse their rights, including interfering with the rights of other states or executing their rights with no consideration over how it might impact external parties.³³ In this article's context, this assumes countries with good faith would partake in space mining without complicating future access for other countries.

3.2. National Law

This section serves as a look into how states implement existing law and also strive to conduct legal interpretation which sides with their own domestic interests. Zooming into national law is imperative in understanding the full extent of legal impacts of space law towards all actors, since in the previous section it is apparent that the effectivity of this regime is, to some extent, dependent on how committed the states are in implementing it.

Having domestic, enforceable regulation is important because national law does not merely translate international law into its local language nor limit its development. Rather, it serves as an initial step in providing legal certainty (for space mining in this context), ensuring present and projected investments would go well.³⁴

National law reflects whether space mining practices are in line with terms laid down by legal instruments, binding or not. Therefore, it should be formulated in a consistent manner with prevailing international law. This article shall examine the national law existing in United States (US) and Luxembourg which govern space mining.

3.2.1. United States

US shapes their law to be conducive for economic growth, particularly for their ever-important private sector. Their 2015 Space Resource Exploration and Utilization Act was passed by Congress as part of the U.S. Commercial Space Launch Competitiveness Act. This law urges minimum obstacles for private sector participation, including in

³² The "good faith" principle is one of the bases in forming and implementing legal obligations. Trust and faith are intrinsic characteristics in international cooperation, especially in an era when cooperation in every single aspect of life is vital. Lassa Oppenheim and Hersch Sir Lauterpacht. (1955). *International Law: A Treatise*. London: Longmans, Green & Co.

³³ *Ibid.*

³⁴ Tanja Masson-Zwaan and Neta Palkovitz. (2017) *Regulation of space resource rights: Meeting the needs of States and private parties*. Available online from: <http://www.qil-qdi.org/regulation-space-resource-rights-meeting-needs-states-private-parties/>. [Accessed January 27, 2020].

financing space missions. US citizens reserve the right to own, relocate, utilize, and trade extracted resources from asteroids or other celestial bodies.

The term “US citizen” found in §51301 of Space Resource Exploration and Utilization Act comes from §50902 (1). It includes:

- 1) an individual who is a citizen of the United States;
- 2) an entity organized or existing under the laws of the United States or a State; or
- 3) an entity organized or existing under the laws of a foreign country if the controlling interest [as defined by the Secretary of Transportation] is held by an individual or entity described in sub clause (1) or (1) of this clause.

The phrase applies to foreign companies which abide by US law, including through cooperation with a US company in conducting a space-related project. It incentivizes local companies to seek foreign partners, ultimately benefiting the US space industry.

Other countries expressed qualms towards the Space Resource Exploration and Utilization Act, though no concern was effective enough to hamper missions such as OSIRIS-Rex. There are parts in the act underpinning the non-appropriation principle, meaning the US has no right to claim sovereignty over the moon nor any other celestial bodies. Repeatedly, it emphasizes the importance of executing any international legal obligation in conducting space activities whether it be operated by the state or a company.

To date, US has ratified four out of five space treaties. However, it is neither a member nor signatory state of the Moon Agreement which comparatively sets more detailed grounds for benefits-sharing and the obligation to ensure space resources utilization benefits all mankind.

In practice, US has two agreements concerning OSIRIS-Rex. NASA is to exchange samples with JAXA’s sample collected by Hayabusa2. The contract stands even if a mission fails, meaning both countries reserve the right to get samples even if their own mission fails. This serves as a safety net, ensuring both parties involved gain the maximum benefit from space exploration and acts as further motivation to seek international cooperation.³⁵ Another agreement US has is to give Canada four percent of OSIRIS-Rex’s sample in exchange of Canada’s monitoring services at the launching stage.³⁶ To conclude, a combination of US’ interest in space activities from its private sector coupled with relatively lax regulation proves effective in furthering the overall space exploration development.

3.2.2. Luxembourg

Luxembourg’s 2017 Draft Law on the Exploration and Use of Space Resources (hereinafter Draft Law) makes it the second country to have national regulations on space mining. It allows state ownership of over space resources, basing their reasoning on a parallel with resources collected from the high seas in the Draft Law’s explanatory statement.

Luxembourg examines how the high seas belong to no state, but its biota could become the property of a state or other entity, thus the concept of “no man’s land” is only

³⁵ Stephen Clark. (2014). *NASA, JAXA reach asteroid sample-sharing agreement*. Available online from: <https://spaceflightnow.com/2014/12/15/nasa-jaxa-reach-asteroid-sample-sharing-agreement/>. [Accessed August 10, 2019].

³⁶ *Ibid.*

associated with the sea itself. In space mining context, asteroids, comets, and other celestial bodies cannot be claimed by states, in line with the *res nullius* principle. However, the natural resources in celestial bodies could be used exclusively by whomever exercises effective control over it.

Companies wishing to engage in commercial space activities (resource utilization included) must obtain authorization from the relevant ministry. Operators are obliged to submit documentation on its internal organization structure and chain of command for all involved parties, along with a structured mitigation plan for any potential risks during the mission.

The Draft Law's approach emphasizes the operator's capacity of bearing any financial costs from space mining in proportion to its risks, including potential damages towards third parties. Insurance is obligatory for every component used in the mission. Applicants must submit a financial audit report done by a non-related company as proof. Luxembourg also demands transparency from their companies; applicants must disclose data of their biggest shareholders to ensure it has good reputation.

Experience is another important factor in approving authorization. Two reputable managers with sufficient merit must concur for any decision made in space mining operations. If approved, successful applicants are forbidden from delegating their authority to other people, including middlemen. These constraints exist to ensure there would be no misuse of power given by any authorization. The Luxembourg government oversees the process and observes the actual operation.

Just like the US, Luxembourg has signed or ratified four space treaties, but not the Moon Agreement, repeating the pattern of opting out from the rather more detailed treaty. The Draft Law enforces stringent technical and financial prerequisites which will lead to higher success probabilities, minimizing risks such as space debris or inactive objects which may hamper trajectory paths for other space operations.

However, when it comes to the actual use of acquired resources, it expressly elaborates that space resources may be solely owned by a state, likened to resources from high seas. This interpretation is a form of ownership that grants the authority for entities following Luxembourg's Draft Law to refrain from sharing any space resources, including research results, should they wish to do so. As it stands, this way of interpretation is one of the concerns from non-space faring countries.

3.3. Analysis

The development of legal instruments in space law indicates a growing realization that countries shall strive to explore and exploit outer space in any way imaginable. This interest, shared not only by developed states but also by developing states, gives way to rising efforts in solidifying rights of accessing outer space and its resources.

Space mining still exists as a category of the wider term "exploration and use of outer space", as reflected in existing treaties. There is no special attention given to this activity, and an ideal realization of it in space mining has never been elaborated. Obstacles come in legal voids, such as how the non-appropriation principle is executed for resources brought back to earth.

The space mining industry is an interesting case study on how international and national law could develop in parallel, while assuming developments on an

international level would still happen.³⁷ In the case of Luxembourg and the US, national law is formulated to anticipate and even direct future international law. Both recognize the importance of private actors which may spearhead the industry's development and endeavored that their national law accommodates initiatives from the private sector.

Developing countries' rights have been highlighted, even explicitly stated, but the implementation is dependent on their capability in detecting potential threats and the benevolence of other states. For instance, the obligation to consult states which may be affected by space activities is dependent on conducted studies and whether the executing parties attempt to reach out and seriously consider any possible protests or interference with other space activities. If breached, there is no overarching rule on sanctions nor a body to uphold this obligation.

Having effective control over extracted space resources is an apparent concern when viewing national law from the US and Luxembourg. Terms guaranteeing national companies to exercise ownership over resources, should they succeed in obtaining it, is an undisputable driving force of both countries' growth in space activities.

This ownership is given by using the legal void in space law. Though there is no written restriction for claiming resources brought back to earth, providing ownership still hampers proliferation of space research and space mining for other parties. If done in a large scale in the future, latecomers must endeavor to find alternate locations where they could mine without interfering with existing operations. It goes without saying that this adds an extra burden for future space actors. In addition, owners of resources and/or research results derived from those resources may refuse requests from other parties wishing to increase their expertise in the field. Companies could even sell acquired minerals at ridiculously high prices for a milligram.

Cooperating in space mining projects is a viable alternative to obtain samples. Involvement in facilitation to elevate success rates may be rewarded with access to a predetermined percentage of minerals, as done by US and Canada. This opens a wider chance of access to space resources and may cut costs, but a large gap still remains for developing countries to rival existing advanced space technology.

Difficulties in obtaining capacity is only one barrier in having a successful space mining regime. Another concern is the questionable legal protection for non-space-faring countries, keeping in mind that the low number of states signing and/or ratifying the Moon Agreement would also impact the ability to demand compliance towards this legal instrument. Enforcement relies on the few space faring countries such as Russia, USA, and some European countries to keep each other—and themselves—in check.

Limited oversight resources and the low numbers of space faring countries which ratify the Moon Agreement result in difficult and limited enforcement of non-space faring countries' rights. It is only sensible that Indonesia should prepare itself to face the upcoming space mining regime. Each country is responsible to ensure they own a domestic legal framework which caters to their national interests. The next part of this article aims to examine Indonesia's blueprint in preparing for the coming age of space mining.

³⁷ Tanja Masson-Zwaan and Neta Palkovitz, *op.cit.*

4. Indonesia's Blueprint

Law Number 21 of 2013 on Space Activities (the Space Activities Law) recognizes the need and importance of management and supervision of space activities, both for national interests and maintaining space sustainability.³⁸ This includes efficient use of space resources in attaining the greatest possible benefits.

The Space Activities Law does not apportion any of its parts solely for space mining, or to space resources utilization in a broader term. Rather, future concerns on space resources and its usage may be derived by its instructions for the Indonesian Government to give attention to space technology development and strive for greater human resource capacity so Indonesia may carry out more advanced space activities.³⁹ These goals may be achieved through domestic efforts or through international cooperation with other states and entities.

The Indonesian National Institute of Aeronautics and Space (LAPAN) is the appointed body responsible for executing aerospace activities, including the development of Indonesia's space industry and how space is utilized for national interests. LAPAN plays a role in equipping Indonesia to compete globally. To do this, it has a Strategic Plan which sets targets to be fulfilled at set times.

Regulation of the Chairman of the Indonesian National Institute of Aeronautics and Space Number 3 of 2016 on the Strategic Plan of the Indonesian National Institute of Aeronautics and Space for 2015–2019 is the newest Strategic Plan available at the time this article is written. It does not see space mining as a prioritized issue. However, there are opportunities to regulate space mining, at least on a national level.

Indonesia has ongoing plans to formulate several Draft Government Regulations as mandated by the Law on Space Activities.⁴⁰ One of these drafts is the Draft Government Regulation on the Conduct of Space Activities. It would regulate the prerequisites and operations of commercial space activities, including space mining. The plans to draft this particular regulation has been included in the 2015 Draft Government Regulation and Draft Presidential Regulation preparation program based on the results of the Annual Plenary Meeting organized by Indonesia's National Legal Development Agency on 15–17 December 2014. To date, the draft is still in the making.⁴¹

For long-term plans, Regulation of the President of the Republic of Indonesia Number 45 of 2017 on the Master Plan on the Conduct of Space Activities for 2016–2040 (Master Plan) is the prevailing framework to discuss Indonesia's national interests regarding space activities. The Master Plan envisions Indonesia's space regime to be independent, advanced, and sustainable. One of the criteria for an "advanced" space regime is adaptive regulation, while a "sustainable" regime is marked by sustainable use of resources.⁴² It does not have comprehensive content on space activities for commercial

³⁸ Article 43 (d) Law Number 21 of 2013 on Space Activities.

³⁹ *Ibid.*, Article 3, 41, and 75.

⁴⁰ Runggu Prilia Ardes, *et. al.* (2016). "Pertimbangan Yuridis dan Konsekuensi Pengelompokan RPP sebagai Amanat Undang-Undang Nomor 21 Tahun 2013 tentang Keantariksaan" on *Kajian Kebijakan Penerbangan dan Antariksa*, Bogor: In Media, p. 87. Available online from: https://puskkpa.lapan.go.id/files_arsip/Runggu_Pertimbangan_Yuridis_20162.pdf. [Accessed January 10, 2019].

⁴¹ Regulation of the Chairman of the Indonesian National Institute of Aeronautics and Space Number 3 of 2016 on the Strategic Plan of the Indonesian National Institute of Aeronautics and Space for 2015–2019, p. 41–42.

⁴² Part I of the Annex for Regulation of the President of the Republic of Indonesia Number 45 of 2017 on the Master Plan on the Conduct of Space Activities for 2016–2040.

purposes save space launches and the procurement of satellite imagery, but it is not too early for Indonesia to envision space mining regulation.

While space mining is ways away from becoming a realized industry, there is no wrong in thinking ahead and address the issue of minimum national regulation. Government Regulations would at least act as a means to regulate some aspects of the use of space resources such as licensing space mining projects.

Although not yet a space faring country, Indonesia stands to benefit from having a national space law framework that is able to accommodate space mining. If Indonesia has enacted law regulating space mining, it would be enforceable towards foreign entities planning to conduct space activities on national territory. Having a licensing procedure means Indonesia would be able to ask for detailed information on space missions, whether from foreign or national operators. It puts Indonesia in a stronger position to access information which could be used to learn more about what it takes to conduct space mining and further develop the national space industry.

Operators will also be charged with a greater degree of responsibility and liability. Taking a lesson from Luxembourg's law, insurance and funding must also be given attention. Obligating operators with insurance will rid the Indonesian Government from potential losses if a mission fails or incidents occur which result in damages. Since space activities are assumed to be under government control even when operators are from private companies, governments are obliged to engage with any party wishing to get compensation and be involved throughout the whole process. Following Luxembourg's model, if in the future an Indonesian operator is at fault for third party damages, having insurance means the Indonesian Government would pay relatively little or none at all for its compensation.

Given the possibility that minerals and other extracted materials could be brought back to Indonesia, the mission itself may not end when the spacecraft has landed. Under these circumstances, there needs to be further regulation on the safety of transporting space mining results and provisions for reparations should anything unwanted happens.

Luxembourg's Explanatory Statement for its Draft Law states that the government shall continuously support strong and effective cooperation with other nations, such as how the European Space Agency (ESA) operates.⁴³ This is also an initiative the Indonesian Government could take up in the future, likened to how spaceports are regulated in Indonesia's Space Activities Law.

A potential regulation which may touch on space mining is the Draft Government Regulation on Commercial Space Activities. Article 37 and Article 84 of the Indonesian Space Activities Law called for this regulation. So far, it has discussed ongoing businesses pertaining to the space industry, challenges and opportunities for these businesses, and suggestions for overcoming existing challenges. The scope and aim of the draft has been identified, but it is still in the early stages of regulation and no draft has been made publicly available per the period of this article.⁴⁴

⁴³ Explanatory Statement Draft Law on the Exploration and Use of Space Resources.

⁴⁴ Faculty of Law, University of Indonesia. (2020). FGD: *Rancangan Peraturan Pemerintah Tentang Kegiatan Komersial Keantariksaan*. Available online from: <https://law.ui.ac.id/v3/fgd-rancangan-peraturan-pemerintah-tentang-kegiatan-komersial-keantariksaan/>. [Accessed August 6, 2020].

Ideally, this regulation should include the scope of parties that have to abide by it, considering that (foreign) private companies may be the main driving force of commercial space activities development. Indonesia can learn from the §51301 of Space Resource Exploration and Utilization Act model as it is inclusive of all possible parties.

Insurance and licenses are also important. As explained above, having licensing means Indonesian operators or operators operating in Indonesian territory would have to abide by these laws. The Indonesian Government can put stricter requirements for safety and security measures and also oblige a certain level of insurance to relieve itself from possible unwanted financial burdens. To compensate for this, financial incentives can come in the form of tax breaks.

The final issue is ownership; how would the Indonesian Government approach ownership of space resources? For the betterment of research, LAPAN as the national focal point may be entitled to a small portion of any minerals that is acquired with Indonesia's assistance, or require access to research reports done by operators. Considering international law has yet to explicitly ban nor allow jurisdiction over mined resources, there is room for interpretation.

If Indonesia were to abide by the Space Benefits Declaration, it would make no attempts to provide exclusivity of ownership to any operators, as both the US and Luxembourg have faced protests regarding this issue. Rather, it could instead opt for the inclusion of Indonesian actors, whether it be LAPAN or other national entities, in the research and/or extraction process of space resources, as well as any results therefrom.

Besides preparing regulations, Indonesia also needs to build its national capacity by acquiring the necessary technology, funding, and human resource. The lack of attention given to space mining prospects is unfortunate but does not prevent Indonesia from taking part in future practices. It is a shame that space mining has not gotten any spotlight from the Law on Space Activities, LAPAN's Strategic Plan, nor the Master Plan. Technology acquisition mention in the Law on Space Activities has only discussed rocket technology, satellites, and spin-off technology such as for healthcare services, education, and long-distance conference calls. In both LAPAN's Strategic Plan and Master Plan, there are schemes to develop technology which could support space objects and spaceport operations, but space mining-related technology is not mentioned. Plans to form an umbrella law which could cover space mining also has not been fruitful.

Indonesia can still acquire needed technology to conduct space mining in the future. A unique opportunity to benefit from space mining comes from the plan to build a spaceport. If Indonesia manages to facilitate space mining mission launches, it could negotiate this service for access to extracted space resources or research results with the operating state.

LAPAN is tasked to locate the most strategic spot for spaceport construction and may cooperate with other entities. The government will assist in the form of funding. If taken in parallel, this could mean added flexibility for LAPAN to conduct deeper research in space mining-related activities, even cooperation with other countries. The new spaceport will be built at Biak, with two phases; the first one with a completion target by 2024, and gradual second phase to accommodate commercial launches.⁴⁵ This

⁴⁵ Christina Daumann. (2019). *Indonesia Building New 'Bigger' Spaceport*. Available online from: <https://asgardia.space/en/news/Indonesia-Building-New-Bigger-Spaceport>. [Accessed August 3, 2020].

new spaceport is located at the equator and it will take less propellant—and thus less cost—to launch rockets and space objects. Financially, this is an attractive point for other countries to cooperate with Indonesia, and it serves as an opening for Indonesia to assert some leverage in negotiations. For example, Indonesia could require access to mined resources and the research that comes from it, following the OSIRIS-Rex cooperation model.

Opportunities for cooperation also exist in international and regional forums where Indonesia holds membership such as COPUOS. It is possible for Indonesia to monitor developments regarding space mining and developments from other states and enterprises through their presentations of space mining models they use.

Overall, Indonesia's blueprint is not yet able accommodate space mining, but opportunities to ensure national interests are not hampered by future space mining practices in the future still exist. The important thing is to take advantage of the momentum so Indonesia could reap optimum benefits from existing opportunities.

5. Conclusion

Behind the fantastic value space mining has to offer, there are worrying issue for non-space faring countries regarding their right to access space resources. OST prohibits states from claiming ownership over space resources and there are principles in the Moon Agreement which recognize developing countries' rights to enjoy benefits derived from space resources. A good start, but it must be followed by regulations from non-space faring countries themselves, especially with the absence of a system to enforce those rights.

Space mining is not explicitly included in Indonesia's space law. The Draft Government Regulation on the Conduct of Space Activities could also serve as an umbrella law for space mining. Indonesia needs to regulate space mining, including the scope of actors that must abide by Indonesian law, space mining financing and insurance, licensing with regard to safety and security issues, and on resource ownership. For long-term plans, the establishment of a spaceport at Biak may incur international cooperation. Indonesia needs to take this opportunity and create a cooperation framework that allows LAPAN or other national entities access to the space minerals itself or researches conducted on it. To conclude, Indonesia's current blueprint is not yet detailed enough to accommodate space mining. Opportunities to gain benefit from space mining still exist. In the future, hopefully Indonesia is able to have regulations which could facilitate technology transfer, acquisition, and the establishment of space mining as part of the space industry.

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The author(s) declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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